

## THE QUALITY OF AGRICULTURAL LANDS FROM THE ADMINISTRATIVE TERRITORY OF RADUCANENI, IASI COUNTY

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### Abstract

Soil represents the result of action taken by various processes determined by environmental factors, continuously adapting to natural and/or artificial changes of the environment, recording through certain phenomena, processes and characteristics, the main evolutionary moments. Agricultural land quality is determined by assessment, according to which, in Romania, agricultural land belongs to five quality classes differentiated based on their assessment grades. The assessment study is conducted on various agricultural lands, which should be as homogeneous as possible from the viewpoint of their environmental factors and vegetation factors. In the Răducăneni administrative-territorial unit, the 70 simple soil units and 6 complex soil units identified, belonging to the Protisoils, Cernisoils, Luvisols, Hydriols and Antrisoils classes, were included, depending on their slope and exposure, in elementary land units, which resulted in 171 simple ecologically homogeneous territories and 36 complex ones. Relying on the land quality and productivity assessment grades calculated for the 207 ecologically homogeneous territories, we decided that the surveyed land belonged to the arable use category, i.e. to I, II, III, IV and V quality classes. 50.9% (3372.68 ha) of the total mapped area of 6624 ha belongs to the lower quality classes, namely IV and V, 35.1% (2323.17 ha) to the III quality class and only 14% (928.15 ha) to the higher I and II quality classes.

**Key words:** agricultural land quality assessment, ecologically homogeneous land, soil units

The physio-geographical conditions of Romania present a large diversity of the main landforms (plain, hill, mountain), resulting in a broad variation of some parameters: altitude, slope of the land, types of use, soil divisions and specific quantitative and qualitative characteristics (Dumitru M. *et al*, 2011).

Soil quality comprises all the soil features which ensure a certain rate of natural fertility. Land quality comprises both soil fertility and the way of manifestation towards plants of the other environment factors (climatic, geomorphological and hydrological).

Munteanu I. (2005) shows that, in order to define and fully and correctly understand soil at a local level, it is necessary to examine the cover of the soil (pedosphere) on very large geographical areas, in connection to climatic areas and with the ever-increasing influence of the anthropic factor.

The role of the soil is generally accepted, not only in promoting and developing sustainable agriculture, preserving the quality of the environment, in global climate changes, in preserving biodiversity, but also in economy development as a whole.

Blum W. and Santelises A. (1994) proved that, in order to emphasize the undeniable importance of the soil in the harmonious development of economy as a whole, able to ensure safe and prosperous conditions for future generations, one must know the functions that it fulfills.

The value of crops and the net cadastre revenue, for long periods of time, may be determined scientifically by cadastre assessment methods applied to agricultural land, thus preventing the undesirable consequences of approximations relying on uncertain data.

### MATERIAL AND METHOD

In physical-geographical terms, the administrative division of Raducaneni is located at approximately 40 km south-east of the municipality of Iasi (*figure 1*), while geologically, it is included in the broader area of Platforma Moldoveneasca, of which sedimentary bedding, the erosion revealed Bessarabian formations (medium Sarmatium), Chersonian (Upper Sarmatium) and Miocenes, which reveal a slight pitch, of approximately 7-8 m/km on NNW-SSE direction (Jeanrenaud P., Saraiman A., 1995; Ionesi L. *et al*, 2005).

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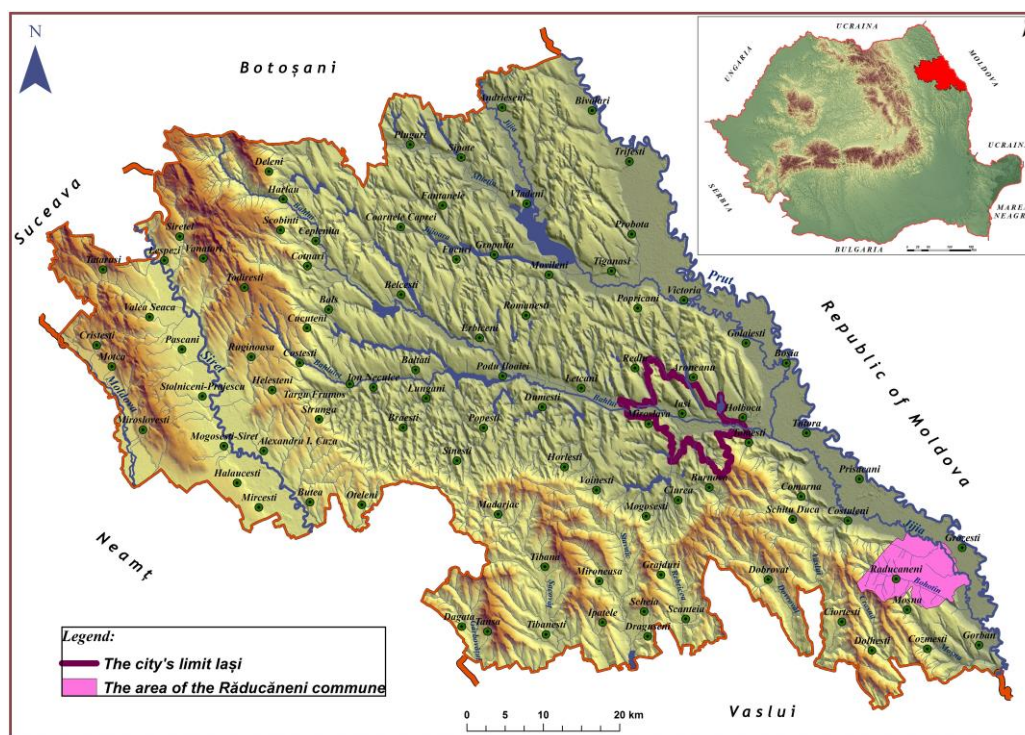


Figure 1 Physical-geographical positioning of Raducaneni commune

Raducaneni commune comprises the following inner-locations: Raducaneni, Rosu, Bohotin and Isaiia and borders the following administrative divisions: Costuleni, Prisecani and Grozesti in the north; Grozesti in the east; Gorban in the south-east; Mosna in the south; Ciortesti in the south-west and Costuleni in the west.

According to the Land Title and Survey Office from Iasi, the total surface area of the studied territory is of 8739 ha, out of which 6539 ha represents agricultural land and 2200 ha, non-agricultural land. Agricultural land represents 75% of the total surface area of the territorial and administrative division and it is made up of 3863 ha arable land, 956 ha meadows, 840 ha grasslands, 582 ha vineyards and 298 ha orchards. The surface, as the object of this study, is of 6624 ha, out of which 6539 ha represents agricultural land and 85 ha, non-productive land.

In order to stress out the geomorphological particularities of the Bohotin catchment, there have been used both traditional research methods (observations, field measurements, geomorphological mappings, statistical and mathematical processing, analysis, synthesis) and modern methods, based on GIS softs. Cartographic materials were obtained with the help of TNTmips v.6.9 and QGIS, and the statistical processing was carried out by using Microsoft Office Excel 2007. An important step in spatial modelling was the implementations of the Digital Field Model (DFM), by vectorization of contour lines and quota on the topographical plans, scale 1:5000. Based on all these, thematic maps regarding altitude, inclination, field exposition, shading etc., have been drawn-up.

In order to characterize the soil cover, the pedological study elaborated by the Land Title and Survey Office from Iasi was consulted and processed by using a uniform approach, scale 1:5000. The map of soils from this study was scanned and geo-referenced and the ground units were subsequently vectorized.

The assessment and field grouping on quality classes and uses was carried out according to *"The methodology of pedological study development"*, 2<sup>nd</sup> volume, National Research and Development for Soil Science, Bucharest, 1987, by using the BDUST ver. 9.5 software. The current use of land map is based on the cadastral maps drawn-up by the National Agency of Land Title and Field Survey from Bucharest and the orthophotomaps from the 2005 edition.

## RESULTS AND DISCUSSION

A basic requirement for the performance of agricultural land quality assessment works is the existence and use of pedological maps.

Within the territorial division of Raducaneni, there have been identified, according to the Romanian System of Soil Taxonomy (RSST, 2012), 70 simple soil divisions and 6 complex ground divisions, from five classes of soils, including 6 types of soil and over 30 sub-types, divided into lower level categories, based on their physical, chemical and agro-productive properties (figure 2).

The simple US 1-US 25 soil units are of the alluvial soil type of the Protisoils class, US 26-US 42 of the chernozem type and US 43-US 50 of the

phaeozem type of the Chernisols class, US 51-US 57 of the preluvosol type of the Luvisols class, US 58-US 59 gleysol of the Hydrisols class, US 60-US 69 and US 70 (gullies) of the anthrosol type of the Antrisol class.

The complex US 701-US 703 units occur in the stabilized landslides area, US 704-US 705 in the semi-active landslides area and US 706 in the active landslides area.

Cernisols (1862 ha chernozems and 515 ha phaeozems) are the most wide-spread, representing 36% of the pedologically studied surface (6624 ha), followed, at small distance, by protisols (2066 ha aluviosols) in a proportion of 31%. Next, the class of antrisol occupies the third position as proportion, 21%, followed by the class of luvisols (677 ha preluvosols) 10% and hydrosols class (145 ha gleisols) 2%.

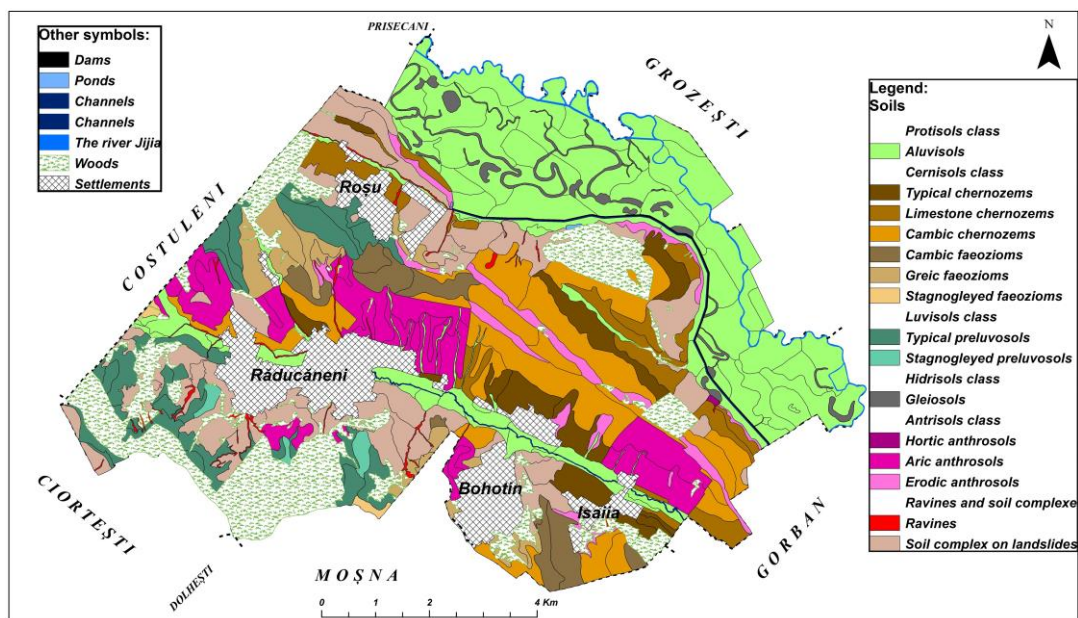


Figure 2 Soil Units Map (SU)

The identified soil units were divided, according to the cliff and view, into elementary field units, homogenous from the perspective of all the soil and field features, called ecological homogeneous territories (TEO's). The ecological homogeneous territory represents the basic unit for which the bonitation grades, the quality classes, the favorability classes, the reliability classes, etc. are calculated, based on the indicators.

The overall morphology of Raducaneni territory is typical to the Central Moldovenesc Plateau, because it is made up of plateaus, inter-river heights and relatively deep, asymmetrical valleys, completed by the Prut meadow in the east.

As for field inclination within the territory of Raducaneni (figure 3), a surface of 2519 ha presents slopes smaller than 5%, 1802 ha slopes comprised between 5-10%, 2166 ha slopes of 10-15%, 1387 ha slopes of 15-20%, 635 ha slopes of 20-25%, while a surface of 230 ha has a slope bigger than 25%.

The slope map emphasizes the presence of two lanes with high land pitch, of over 25%. Hence, although the first lane is sinuous, seems very well-defined on the right slope of Bohotin (frontal slope with northern exposition), in the west of Raducaneni, Bohotin and Isaiia.

The second lane, are less sinuous, sliding cornice shaped and has a reduced development within the studied area. It is located on the Bacalul Vechi, La Hartie and Crasnita hills.

A similar situation can be found in the Cozia catchment, where the slope reaches over 25% in the south of Rosu village, until the northern mountainside of Marmurii Hill.

The local landscape is also emphasized by the field exposition which, according to the map in figure 4, reveals the subsequent character, slightly diagonal (sideways) of the Prut and Bohotin valleys, in the generally monoclin structure of Moldova Plateau, specific to 1<sup>st</sup> grade structural asymmetry.

Thus, the shaded, colder and moister slopes with northern, north-eastern and north-eastern orientation, represent approximately 50% (4396 ha) of the administrative territory surface Raducaneni, intermediary slopes with eastern and western orientation occupy approximately 4% (364 ha) and the sunny and warmer slopes with southern, south-western and south-eastern orientation, represent approximately 24% (2086 ha).



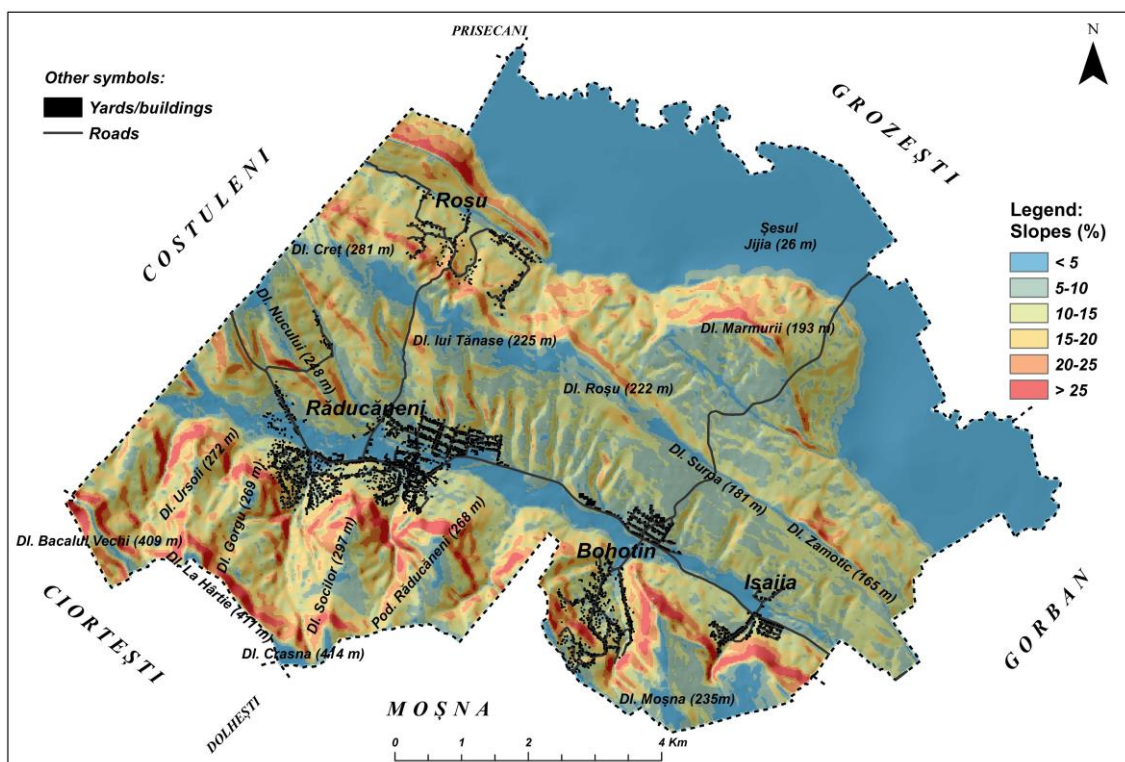


Figure 3 Land Gradient Map

In the context of the prevalence of typical diagonal valleys, oriented on the NV-SE direction, an apparently tight connection between the main landforms and orientation classes of the slopes, stands out. Hence, the most extensive lands are those with general N and NE exposition and

comprise most of the slopes as frontal slopes. At the same time, slopes with S-SV exposition, have a surprisingly narrower development, although structural asymmetries involve an opposite report, a broad expansion of the downsides and a narrow expansion of the front slopes.

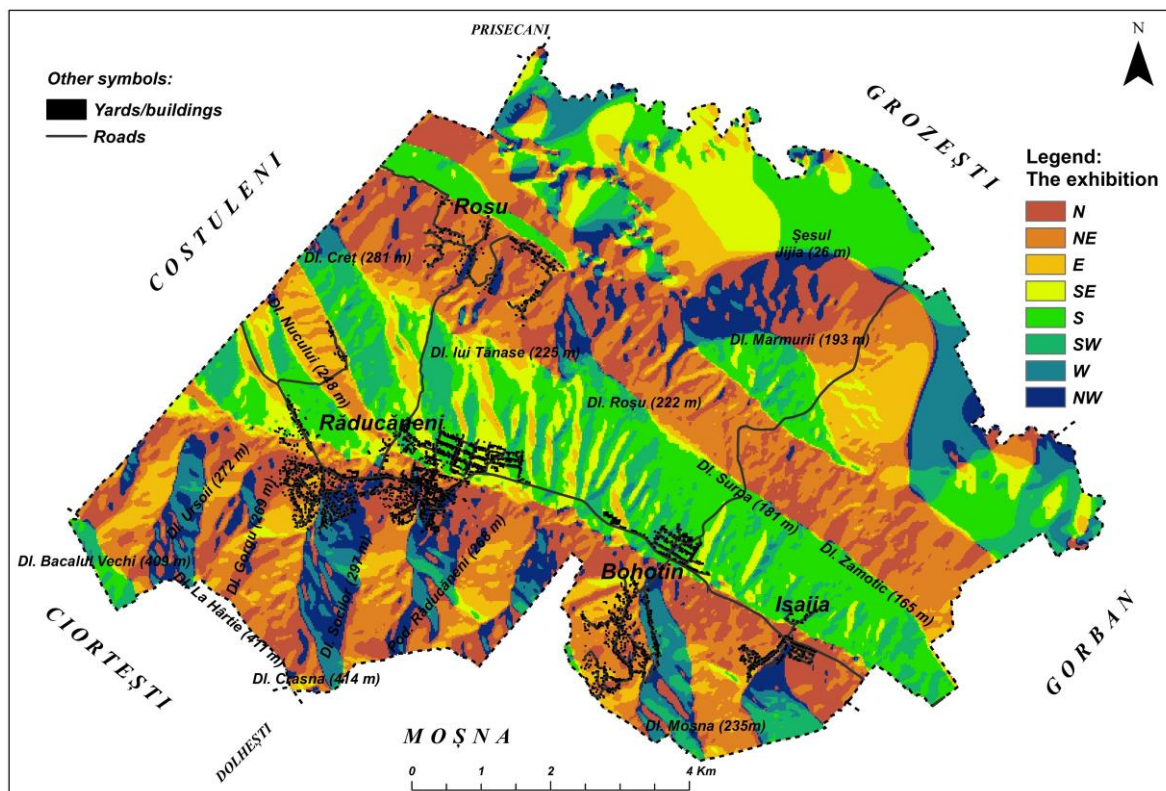


Figure 4 Land Exposure Map

As a consequence of this fragmentation of the field, resulting in 207 ecologically homogeneous territories (TEOs), of which 171 are simple TEOs and 36 are complex TEOs., at the level of which we performed the computing of the bonitation grades, according to cultures and usages, for natural conditions. For that purpose, we extracted the coefficients corresponding to the bonitation indicators in the Methodology for Drafting the Soil Studies- part II, drafted by the I.C.P.A. Bucharest, in 1987, Annexes 3-2, ..., 3-18.

Land gradient is an important indicator when establishing the land quality and productivity grades. Its presence diminishes the favourability of those areas by soil erosion and soil properties impairment.

By analyzing the bonitation coefficients for the declivity of the field, according to the Bonitation Methodology of the Agricultural Fields, we can notice that they vary within very large limits, according to the declivity. Therefore, for the declivities up to 10%, the annual plants which can be bred and the vegetables are slightly penalized with 0.1 points, while straw cereals bear well this declivity of the fields. Once with plants growth, the eight cultures taken into account become more and more sensitive to the declivity of the fields, so that the declivities of more than 25% are penalized with 0.7-0.9 points.

Moreover, landslides presence penalizes the cultures according to the type and intensity of the sliding phenomena. The stabilized landslides occupying a surface of 447 ha, representing 7% of the soil mapped surface (6624 ha), can be successfully used for the straw cereals culture by enforcing the appropriate agricultural soil ameliorative works, penalizing them with 0.2 points only, but these are less recommended for the potato and sugar beet cultures, penalized with 0.4 points. The fields affected by semi-active (415 ha), active landslides (107 ha) and gully erosion occupying 51 ha, namely 9% of the soil mapped surface are completely contraindicated for agricultural plants culture.

Salinization and alkalization are important indicators which diminish the quality of the agricultural land in the Raducaneni Commune, due to the fact that a large area is affected, more precisely 1573 ha, i.e. about 24% of the mapped area, by penalizing crops at mild intensity by land quality and productivity assessment coefficients of 0.7-0.9, at moderate intensity by 0.4-0.7, at strong

intensity by 0.1-0.3 and at excessive intensity by coefficients of 0.1.

The mild gleying affecting 321 ha (5%) of the mapped area does not penalize the 8 crops (wheat, barley, maize, sunflower, potato, sugar beet, soy and peas/beans), which are considered when establishing the arable land quality and productivity grade, yet the moderate gleying occurring on 1019 ha (15%), the strong gleying affecting 647 ha (10%) and the excessive gleying present on 146 ha (2%) penalize the abovementioned crops by 0.1-0.3 points, as gleying, and especially excessive gleying, is an unfavourable characteristic.

The land quality and productivity assessment grade in natural conditions, on crops, was calculated by multiplying by 100 the product of the coefficients of the 17 indicators, which are directly involved in the establishment of the land quality and productivity grade.

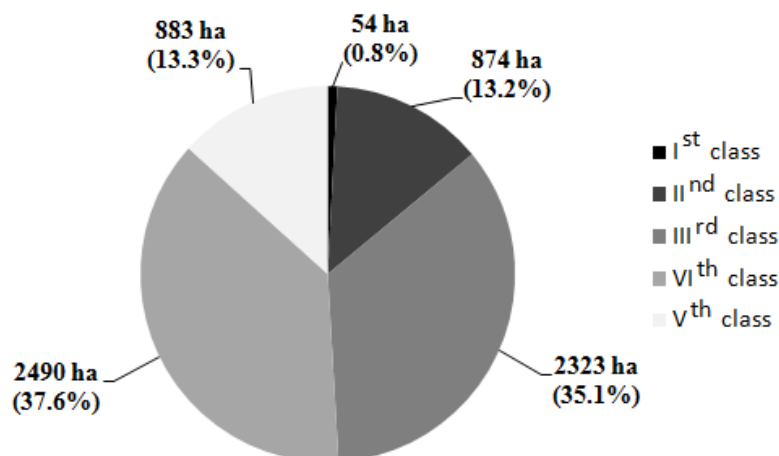
At the soil units' level, the bonitation grade was computed as weighted average of the bonitation grades corresponding to the ecological homogeneous territories comprised.

The arable land quality and productivity grade was calculated with the observance of the regulations in force, as the arithmetic mean of the grades of the 8 most frequent crops: wheat, barley, maize, sunflower, potato, sugar beet, soy and peas/beans.

Based on the obtained bonitation grades, the result is that the mapped surface of 6624 ha of the Raducaneni territorial and administrative division, of Iasi county, frames within the I-st, II-nd, III-rd, IV-th and V-th quality classes, for the arable usage category (*figure 5*). The analysis of the geomorphologic indicators concerning land gradient, landslides, deep erosion (gullies), as well as of the pedological indicators regarding organic matter content, soil reaction, soil texture, gleying/stagnogleying, salinization and alkalization, revealed that the soils in the area under survey are severely degraded.

Otherwise, it is noted that half (50.9%) of the pedologically mapped soils present very and extremely severe restrictive factors of agricultural production, falling within the 4<sup>th</sup> and 5<sup>th</sup> quality classes, with poorly and very poorly fertile soils.

Good and moderately good soils for agricultural purposes, occupy 48.3% of the pedologically mapped soils and can be found in the 2<sup>nd</sup> and 3<sup>rd</sup> quality class and the very fertile soils can be found in the 1<sup>st</sup> quality class, in a percentage of 0.8%.



**Cartographed area - 6624 ha**

**Figure 5 The share of quality classes for arable use**

Low quality of farmland of Raducaneni village is shown by the average weighted mark of 40 on the total mapped area of 6624 ha that includes this area into class IV quality.

### CONCLUSIONS

Within the territorial and administrative division of Raducaneni, there were identified 70 simple ground divisions and 6 complex ground divisions, belonging to the Chernisols, Protisols, Antrisol, Luvisols and Hydrosols classes.

Chernozems make up 28.10% of all the soils, phaeozems 7.77%, aluvisols 31.20%, anthrosols 20.52%, preluvisols 10.22%, gleysols 2.19% of the entire mapped area.

The slope and land display outside the studied area, have imposed a delimitation of 207 homogenous ecological divisions (HED) within the ground division, out of which 171 were simple HEDs and 36 complex HEDs, after determining their quality according to use and crops, in natural conditions.

In the pedo-morphological conditions from the studied area, the factors which significantly penalize quality rates according to their use and crops, are the slopes of the field, landslides, gleization, salinization and alkalization.

The fields of Raducaneni commune have an elevated degree of deterioration: 50.9% (3372.68 ha) represents arable land, included in the 4<sup>th</sup> and 5<sup>th</sup> lower quality classes, while 35.1% (2323.17 ha) are included in the 3<sup>rd</sup> medium quality class. In the 2<sup>nd</sup> and 1<sup>st</sup> high-quality classes, are to be

found 13.2% (873.93 ha), namely 0.8% (54.22 ha) of the studied area.

Soil, climate, landscape and hydrologic conditions require an efficient use of land, implementation of modern crops technologies, use of adequate agricultural machinery and higher quality biological material. Also, it is recommended that land shall be exploited by using crops that obtained high quality marks and also these shall contribute to prevention and fight against soil erosion and landslides.

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